UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

VENTANA MEDICAL SYSTEMS, INC., Plaintiff, v. DAKOCYTOMATION CALIFORNIA INC., Defendant.	Civil Action No. 04-1522-GMS

DECLARATION OF MATTHEW R. REED IN SUPPORT OF PLAINTIFF VENTANA MEDICAL SYSTEMS, INC.'S ANSWERING CLAIM CONSTRUCTION BRIEF

I, Matthew R. Reed, declare:

1. I am an attorney with the law firm of Wilson Sonsini Goodrich & Rosati, PC, counsel of record for Plaintiff Ventana Medical Systems, Inc. ("Ventana"), in the above-referenced matter. I have personal knowledge of the facts stated herein and would competently testify thereto.

2. Attached hereto as Exhibit F is a true and correct copy of U.S. Patent Number 4,259,006.

3. Attached hereto as Exhibit G is a true and correct copy of U.S. Patent Number 5,161,458.

4. Attached hereto as Exhibit H is a true and correct copy of U.S. Patent Number 5,672,231.

5. Attached hereto as Exhibit I is a true and correct copy an excerpt from The American Heritage Dictionary of the English Language (4th ed. 2000).

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct. Executed this 7th day of November, 2005 in Palo Alto, California.

Matthew R. Reed

Exhibit F

United States Patent [19]

Phillips et al.

[11] **4,259,006**

[45] **Mar. 31, 1981**

[54] **AIR JET MEANS FOR REMOVING LIQUID FROM A CONDUCTIVE SURFACE**

[75] Inventors: **Edwin R. Phillips**, Rosemont; **Raymond J. Stankiewicz**, Philadelphia, both of Pa.

[73] Assignee: **Sperry Corporation**, New York, N.Y.

[21] Appl. No.: **67,980**

[22] Filed: **Aug. 20, 1979**

[51] **Int. Cl.**[3] **G03G 15/10**

[52] **U.S. Cl.** **355/10**; 118/63; 118/662

[58] **Field of Search** ..... 355/10, 3 R; 118/662, 118/660, 63; 430/117-119

[56] **References Cited**

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4,168,119	9/1979	Nishimura et al.	355/10
4,181,094	1/1980	Gardiner	118/63 X

Primary Examiner—Richard L. Moses
Attorney, Agent, or Firm—Thomas J. Scott; William E. Cleaver; Edward M. Farrell

[57] **ABSTRACT**

An electrostatic copying machine includes a reservoir for liquid developer made up of toner particles in a dispersant. A photoconductive drum, adapted after receiving a latent electrostatic image thereon to pass through the liquid developer in the reservoir and to have an electrostatic image developed on the drum. A metering roller for removing excess dispersant is positioned between the reservoir and an air knife which projects a sharp thin jet of pressurized air at about a 45 degree angle with respect to the surface of the drum. The air pressure produced by the air knife drives any remaining spent dispersant on the surface of the drum back to the reservoir by way of the metering roller and the latent image on the drum is subsequently transferred to paper.

2 Claims, 5 Drawing Figures

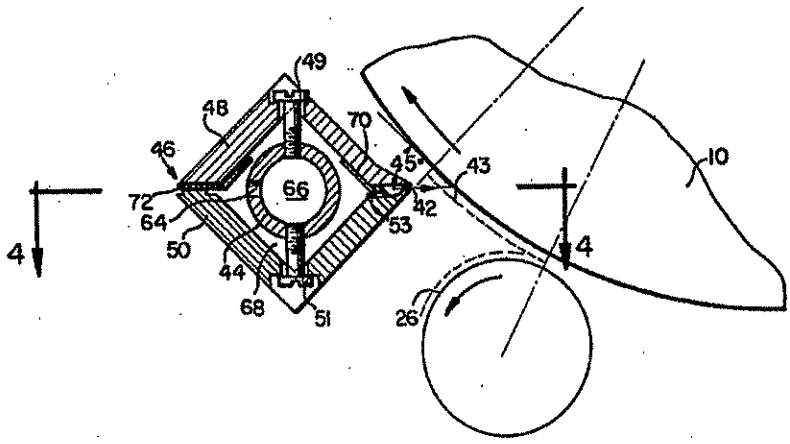

FIG. 1

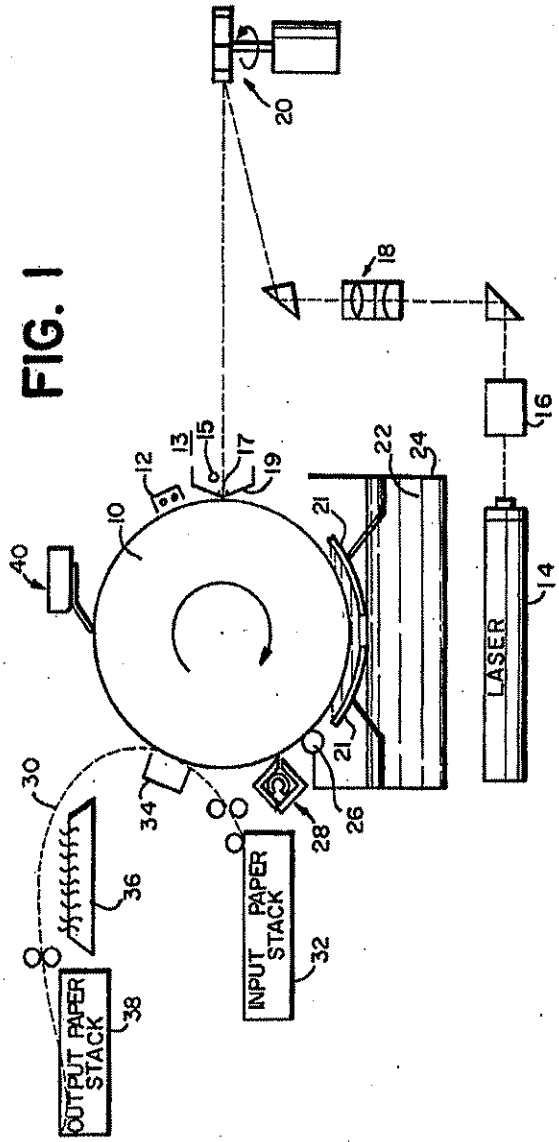
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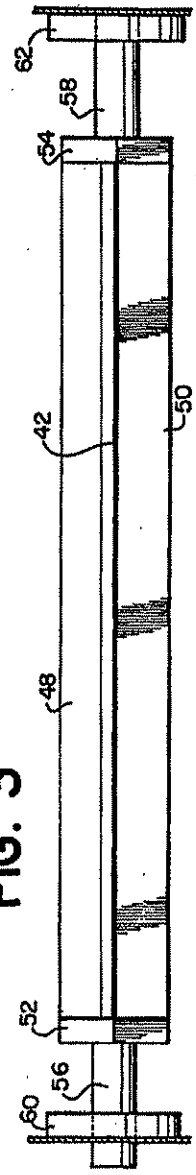
FIG. 3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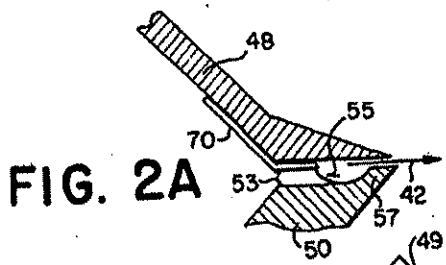

FIG. 2A

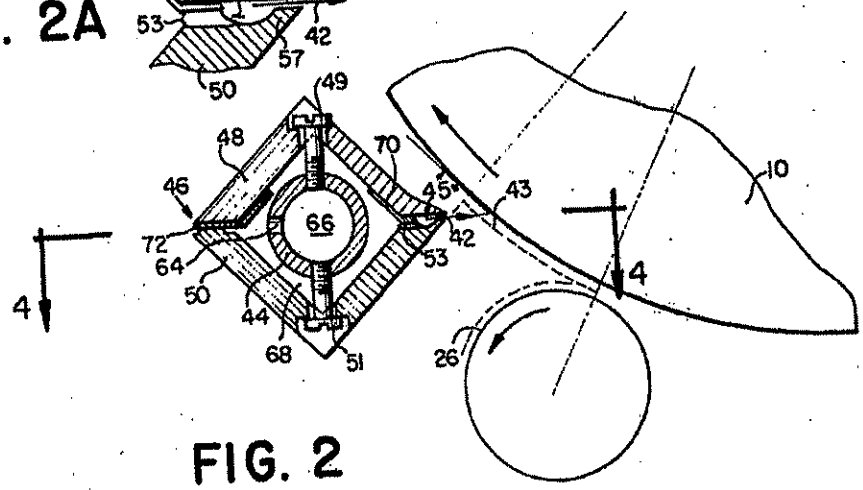

FIG. 2

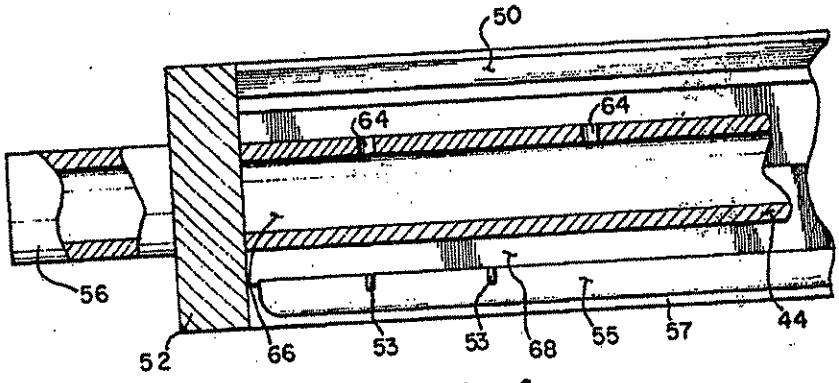

FIG. 4

AIR JET MEANS FOR REMOVING LIQUID FROM A CONDUCTIVE SURFACE

BACKGROUND OF THE INVENTION

The use of electrophotographic copiers as computer output printing devices is well known. In one such system, with which the present invention is related, a liquid electrostatic copier includes a rotatable drum which has a photoconductive surface. The surface of the drum is first moved past a charging station. An image to be copied is then projected onto the drum at an exposure station. After leaving the exposure station, the drum has a latent electrostatic image thereon. The drum then moves through apparatus which includes a liquid developer having charged toner particles suspended in a suitable carrier liquid or dispersant. The drum then leaves the liquid developer with a developed electrostatic image produced by the toner particles being attracted to the latent image on the drum. After the drum leaves the liquid developer, it is brought in contact with paper. The toner is transferred from the surface of the drum onto the paper. Electrostatic liquid developer systems of the type mentioned have been described in numerous patents and publications.

It is advantageous to remove excess liquid developer from the drum after the image has been developed. Removing the excess liquid developer from the drum reduces the amount of carrier liquid that is transferred to the paper and minimizes the likelihood of smudging of the resultant image. Furthermore, when the excess liquid developer is removed from the drum less heat is required to fix the image transferred from the drum to the paper. Additionally, as a result of reducing the amount of liquid developer transferred to the paper the quantity of vapors generated by evaporation of the carrier liquid to pollute the air is also reduced and a more precise and controllable transfer of the dry toner particles to the paper is accomplished. Removing and reusing excess dispersant is an important feature because petroleum products are used in the manufacture of dispersant and the cost of such products have been increasing dramatically.

In the prior art, absorbent rollers and driers have been used for removing the excess dispersant. It is also known to use air knives for this purpose. Such air knives utilize an air jet to blow the dispersant material off the drum while leaving the solid toner particles electrostatically retained on the electrostatic surface thereof. Air knives of this type have been disclosed in U.S. Pat. Nos. 3,741,643; 3,100,426; 3,811,765 and others. The present invention relates to such an air knife in combination with other means and methods to return the dispersant to a reservoir.

One of the considerations in using an air knife to remove excess dispersant from a drum is to provide a reliable and efficient arrangement without the use of excess power. For example, if the air jet employed is too wide, then more power is required to produce the jet and the tendency of the developed image to become distorted is increased. On the other hand, if the jet is too narrow, then the excess carrier liquid will not be removed sufficiently.

In designing an air knife, it is important that the air jet projected be uniformly distributed across a relatively wide area of the drum. If this is not done, a distortion of the image may result.

Also, it is important that the air knife alone not be relied upon to return the removed excess dispersant to a reservoir. In addition, it is desirable to remove some of the excess dispersant from the drum by metering or otherwise prior to subjecting it to the air jet from the air knife.

SUMMARY OF THE INVENTION

In accordance with the present invention, an electrostatic laser printer machine utilizing a liquid developer made up of toner particles and a liquid carrier in a reservoir is provided. A rotating drum including a photoconductive surface having a latent electrostatic image is passed through the liquid developer to produce an image thereon. A metering roller for removing excess dispersant is positioned proximate the surface of the drum between the reservoir and an air knife which is disposed at about a 45° angle with respect to the rotating surface of the drum to drive the spent dispersant back to the metering roller which returns the spent dispersant to the reservoir.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagram illustrating a general system in which the present invention may be used;

FIG. 2 is an enlarged view of a portion of FIG. 1;

FIG. 2*a* is an enlarged view of a section of the air knife illustrated in FIG. 2;

FIG. 3 is a view of an air knife structure, in accordance with the present invention; and

FIG. 4 is a cross-sectional view, partly broken away, taken along lines 4—4 of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, a typical system in which the present invention may be used is illustrated. A positive corona discharge from a source 12 is applied to the surface of a rotatable drum 10 leaving the surface with a net positive charge. The data to be copied is provided in the form of modulated laser signals which are produced by a laser source 14 and a modulator 16, and coupled through a lens arrangement 18 to rotating mirrors 20. The modulated laser signals are reflected by the mirrors 20 and projected onto the photoelectric surface of the drum 10 through a negative discharged corona element 13 which includes an electrical wire 15 and a beam directing plate 19 having an aperature 17. The modulated laser signals projected onto the drum 10 produce a negative discharge corona 20 which removes the positive charge in that particular area of the drum because the drum becomes a conductor in the presence of light. The result produced on the surface of the drum 10 is a series of dots that have no charge, or relatively low charge, compared to the positive charge on the rest of the drum surface.

As the drum 10 continues to rotate, the surface of the drum including the latent electrostatic image which was created by the modulated laser signals moves through a liquid developer 22 which is contained in a reservoir 24. The developer 22 includes a toner and a suitable liquid carrier or dispersant. The carrier may be a kerosene-like or other hydrocarbon material commonly known as Isopar. The toner particles in the developer are positively charged so that they tend to move in the imaged area on the surface of the drum which has the lowest positive charge.

After the image on the drum 10 is developed, the drum passes out of the liquid developer 22 and there is a layer of dispersant mixed with the toner image on the drum. It is at this point in the process that it is desirable to remove the excess dispersant. The drum surface with the excess dispersant is moved past a roller 26 which acts as a metering roller to limit the amount of the excess dispersant retained on the surface of the drum 10 as it rotates passed the position occupied by an air knife 28. As will be subsequently described, the roller 26 acting in conjunction with the air knife 28 returns the removed excess dispersant back to the reservoir 24.

Paper 30 is supplied from a stack 32. A source of negative transfer corona 34 creates a negative electrical charge on the back of the paper 30 which is opposite to the charge of the toner particles on the developed surface of the drum 10. The toner particles leave the drum and go to the paper. The paper 30 with the developed image thereon them moves adjacent a heater 36. The toner particles are melted by the heater 36 thereby becoming fixed to the paper. The paper 30 is then moved to an output paper stack 38. A cleaning station 40 includes a wiper element 41 in sliding contact with the drum 10. The wiper 41 cleans the toner particles which were not transferred to the paper 30 from the surface of the drum. Thus, the drum 10 is ready to receive the next image to be copied.

As illustrated more clearly in FIG. 2, the drum 10 is moved by suitable means, such as a motor, not illustrated, in a clockwise direction and the meter roller 26 is moved in a counterclockwise direction. A jet of air, illustrated by an arrow, from the air knife 28 is projected through a slit opening 42 which extends along the length of the drum 10, and in one preferred embodiment was on the order of ten inches. The jet of air impinges on the surface of the drum at an angle of approximately 45 degrees and produces a viscous drag which pulls the excess liquid, carrier, illustrated by a dashed line 43 from the surface of the drum 10. This angle serves to force the excess liquid carrier back towards the roller 26. The roller 26, moving in a counterclockwise direction, returns the excess liquid carrier removed by the air jet back to the reservoir in addition to the liquid carrier it removes by the metering action. Many of the previous air jet systems for removing excess liquid carrier have resulted in building up a dam of excess liquid carrier on the drum rather than forcing the liquid carrier back to a roller and return it to the reservoir. As mentioned, the roller 26 serves a dual function to meter the amount of liquid carrier which must be removed by the air knife 28 and to return the liquid carrier back to the reservoir 24.

In a preferred embodiment, the roller 26 was 0.630 inches in diameter with a clearance of 0.012 inches provided between the roller 26 and the surface of the drum 10. The clearance between the edge of the air knife slit 42 and the photoconductive surface of the drum 10 was on the order of 0.055 inches.

The detailed structure of the air knife 28 will be described with reference to FIGS. 3 and 4, along with FIG. 2. The air knife 28 comprises an inner tube 44 and an outer enclosure 46 which is a diamond oriented, elongated member of substantially square cross-section constructed of two joined angular members, upper member 48 and lower member 50. The joined members 48 and 50 are secured to the inner tube 44 by a plurality of screws 49 and 51 located in spaced access ports along the length of the upper and lower angles of the enclosure 46 and engaged in corresponding threaded holes located along the length of the inner tube 44.

The inner tube 44 and the outer closure 46 are suitably mounted to a pair of end cap enclosures 52 and 54. Affixed to the outside surfaces of the end cap enclosures 52 and 54 are corresponding elements 56 and 58 that are fixedly connected to corresponding bases 60 and 62 which are attached to the housing structure of the reprographic machine. The element 56 is tubular so as to conduct pressurized air from a source (not illustrated) into an interior chamber 66 of the inner tube 44.

The inner tube 44 includes a plurality of spaced openings 64 as shown in FIG. 4. When the air under pressure is conducted into the inner tube 44, it passes through the openings 64 from the inner chamber 66 formed by the inner tube 44 into an outer chamber 68 formed by the outer surface of the tube 44 and the interior surface of the enclosure 46.

A pair of shims 70 and 72 are provided along the joining edges of the members 48 and 50. The shims are provided to assure precise measurement especially for the size of the nozzle at slit opening 42. In a preferred embodiment, this opening was 0.007 inches. Of course, with precise machining of the parts involved, the use of shims may be eliminated.

As illustrated in FIGS. 2 and 4, the lower member 50 includes an elongated groove 55 in the right upper surface in which is contained a plurality of spaced projections 53 at the inner portion of the groove 55. The outer portion of groove 50 is formed by a lip 57 which extends beyond the upper surface of the member 48. The projections 53 contact the adjacent surface of a shim 70 affixed to the member 48 to maintain the desired spacing between the edges of the members 48 and 50 and provide the slit opening 42 for the air jet. Air is projected between the tips of the members 48 and 50 through the groove 55 between the projections 53. The shim 70 is narrower than the shim 72 and rests on the projections 53. The slit opening 42 is unobstructed by the shim 70 since the shim does not extend sufficiently to block the opening 42. The projections 53 are small enough and sufficiently spaced so that a continuous air jet is projected against the drum 10. In the preferred embodiment with the length of the slit 42 being on the order of ten inches, the spacing between the projections was one and one quarter inches. The spaced projections also provide supports between the members 48 and 50 to maintain the slit opening constant therebetween.

It was found that 0.007 inches opening between the members 48 and 50 provides high efficiency with a minimum power requirement to produce an air jet sufficient to remove excess liquid without distorting the image on the drum. A smaller jet, for example, 0.005 inches, did not effectively remove the excess liquid. On the other hand, higher width jets, such as 0.009 or 0.010 inches tended to distort the image on the drum. Also, the power requirements for air flow became excessive when wide jets were used. The 0.007 inch jet makes it possible to keep within a relatively low blower capacity and reduce the required volume of air to remove the excess liquid. The 0.007 inch jet also provides relatively uniform distribution of the air across the length of the jet area.

Uniform air jet distribution is obtained by the air knife illustrated because of the control of the jet width and the uniformity of the applied pressure. The inner tube 44, with its inner chamber 66, acts as an annulus feeding into a larger volume into the chamber 69 of the outer

enclosure 46. This arrangement provides a relatively constant pressure for the air jet projected through the slit opening 42. The arrangement illustrated allows time for air passing from the first chamber 66 to the second chamber 68 to settle out before the jet is produced. If the air were allowed to pass directly from the first chamber 66 through the slit opening, reduced air suction would result and the air could recombine in the first chamber 66. The series of holes 64 in the inner tube 44, which may be considered metering holes, are designed to produce a uniform pressure in the second chamber 68. The volume provided by the second chamber 68 is large enough so that the pressure therein is relatively stable. A typical pressure in the embodiment illustrated is about four to twelve inches of water air pressure. The energy in the pneumatic system is therefore very low.

We claim:

1. An air knife for projecting a jet of pressurized air through a slit opening towards a photoconductive surface on a rotatable drum having a liquid developer therefrom comprising:

an inner means providing a first chamber having a plurality of spaced openings,

an outer means including a pair of angle members connected together surrounding said inner means to form a second chamber and said slit opening,

one of said angle members including a slot with a plurality of projections disposed therein in contact with the other of said angle members to provide said slit opening,

means for connecting said first chamber to a source of air pressure to cause pressurized air to enter into said first chamber, and pass through said spaced openings into said second chamber whereby a jet of pressurized air is projected through said slit opening towards said photoconductive surface.

2. In combination with an electrostatic reproduction machine utilizing a liquid developer made up of charged toner particles in a liquid carrier, a reservoir for containing said liquid developer, a drum providing a photoconductive surface adapted to receive a latent electrostatic image, and means for rotating said drum so that said photoconductive surface is passed through the liquid developer in said reservoir to develop the image on said drum,

means for removing excess liquid carrier from said photoconductive surface after it has passed through said liquid developer comprising:

roller means disposed in close proximity to said drum to meter the amount of liquid carrier remaining on said photoconductive surface after it has passed through said liquid developer,

an air knife for projecting a jet of pressurized air at said photoconductive surface at about a 45 degree angle with respect to said surface after it has passed said roller means to cause said liquid carrier to be directed towards said roller means,

said air knife includes a relatively narrow slit opening of 0.007+0.001 inches extending longitudinally proximate said photoconductive surface for projecting a relatively uniform jet of pressurized air thereto,

said roller means being disposed between said air knife and said reservoir to receive the liquid carrier resulting from said jet of pressurized air,

said roller further being rotatable in an opposite direction to said drum so that the liquid carrier removed from the photoconductive surface by said jet of pressurized air is received by said roller and is carried away from the surface of said drum and returned downwardly to said reservoir.

* * * * *

Exhibit G

US005161458A

United States Patent [19]

Cheung

[11] Patent Number: 5,161,458

[45] Date of Patent: Nov. 10, 1992

[54] **APPARATUS FOR FORMING FILLED DOUGH PRODUCTS**

[76] Inventor: **Yau T. Cheung**, 2348 S. Canal, Chicago, Ill. 60616

[21] Appl. No.: **737,428**

[22] Filed: **Jul. 29, 1991**

[51] **Int. Cl.**[5] **A21C 9/00**; A21C 9/06; A21C 11/00

[52] **U.S. Cl.** **99/450.6**; 99/450.1; 99/450.7

[58] **Field of Search** 99/450.1, 450.2, 450.6, 99/450.7, 352, 353, 494; 425/110, 112, 383, 324.1; 426/297, 502

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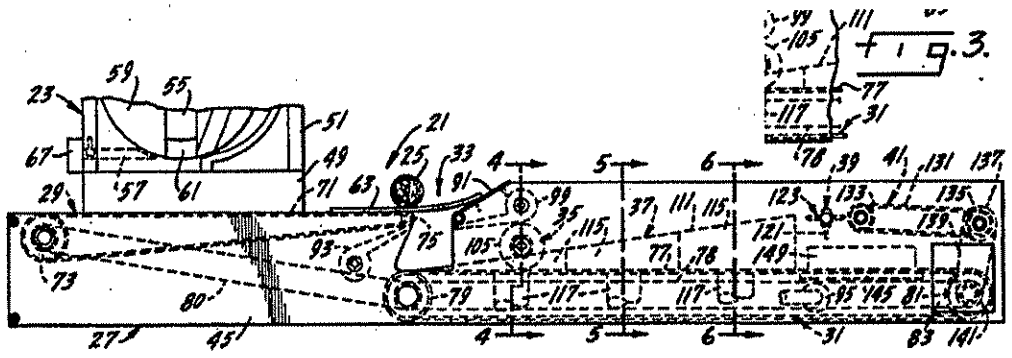
45-21620 7/1970 Japan 99/450.6

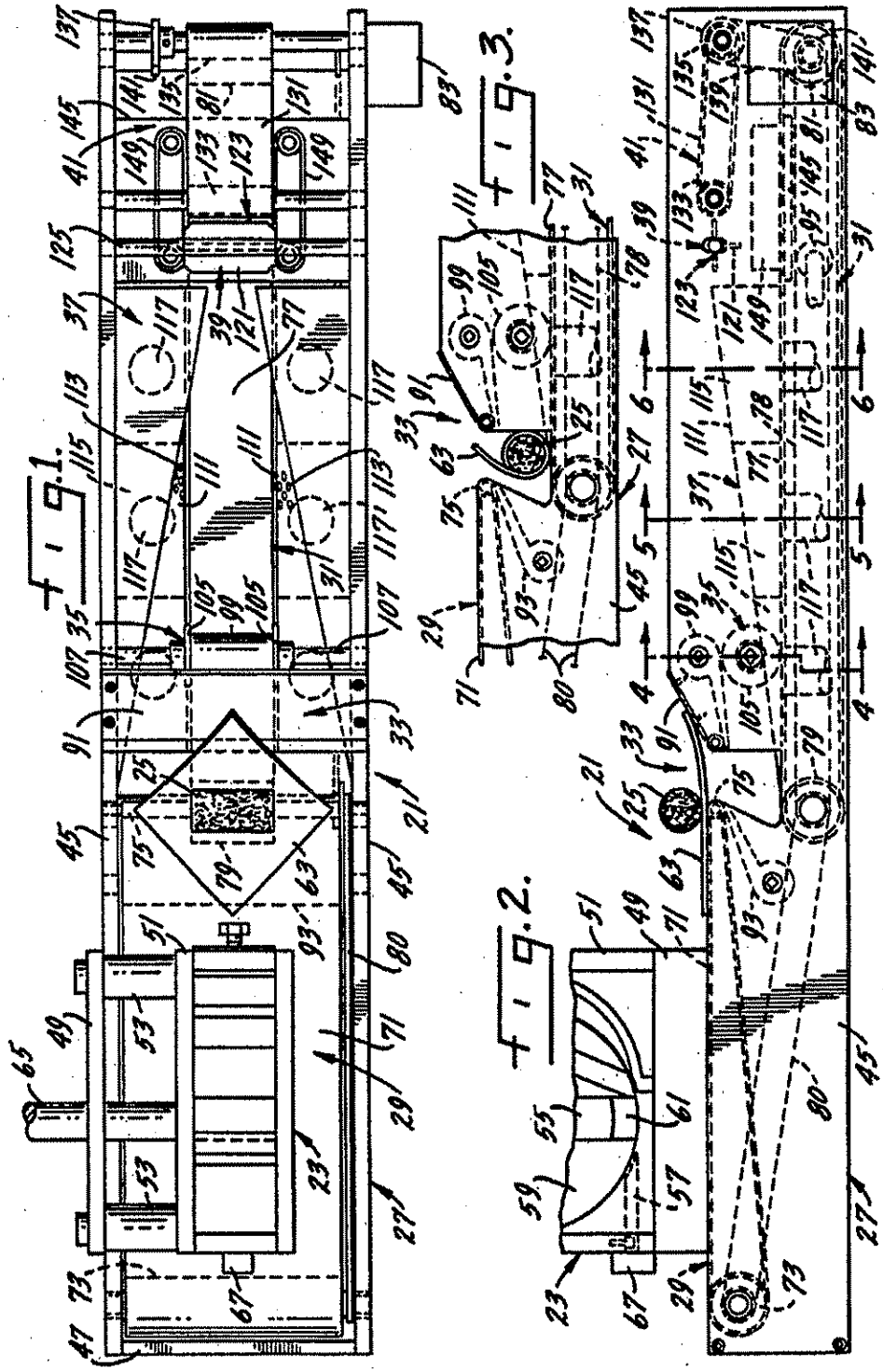
Primary Examiner—Timothy F. Simone
Attorney, Agent, or Firm—Kinzer, Plyer, Dorn, McEachran & Plyer

[57] **ABSTRACT**

An apparatus for forming filled dough products. The apparatus includes a first belt conveyor and a second belt conveyor located below and at the end of the first belt conveyor. A first air jet stream is discharged through a thin rectangular orifice against the underside of a sheet of dough carrying a cylindrical filling as the sheet of dough leaves the first belt conveyor to support the leading edge of the sheet of dough. A deflector engages the leading edge of the sheet of dough to bend the corner thereof upwardly. A second air jet stream discharges through a thin rectangular orifice against the sheet of dough to reversely fold the leading corner of the sheet of dough against the cylindrical filling and also bends the trailing edge of this sheet of dough onto the second conveyor belt after the sheet of dough and the filling have dropped to the second belt conveyor. Rollers crease the sheet of dough outwardly of the cylindrical filling. A third air jet stream discharges through perforations positioned on opposite sides of the second belt conveyor to lift the opposite corners of the sheet of dough about the creases and to fold the corners inwardly over the filling. A paddle blade creases the folded dough rearwardly of the filling. An overhead belt conveyor moving opposite to the second belt conveyor completes the rolling of the dough and filler.

3 Claims, 2 Drawing Sheets





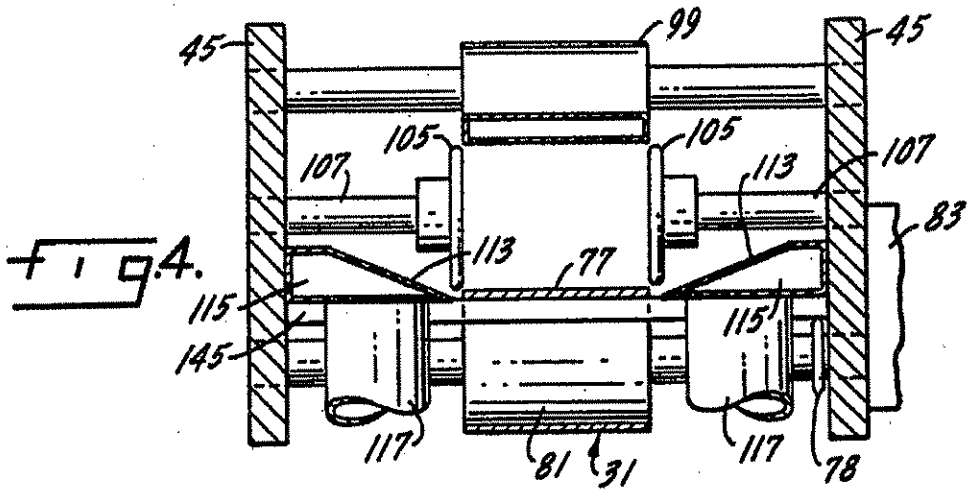


Fig. 4.

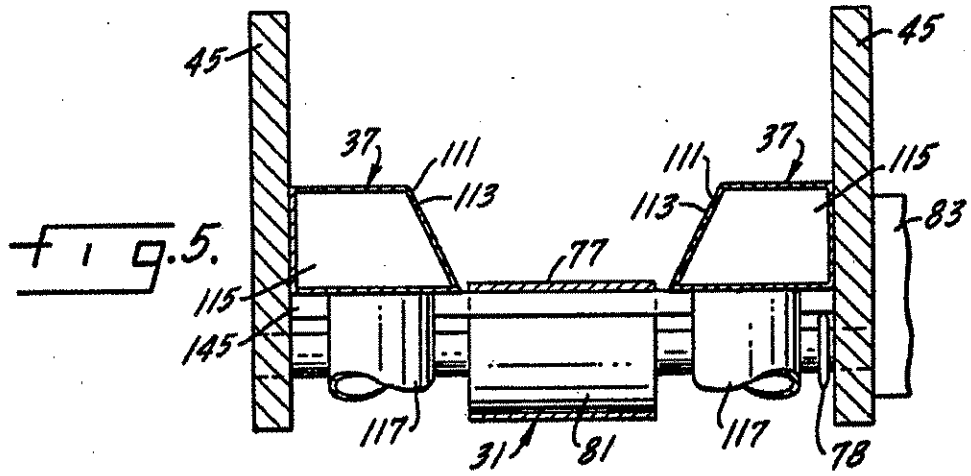


Fig. 5.

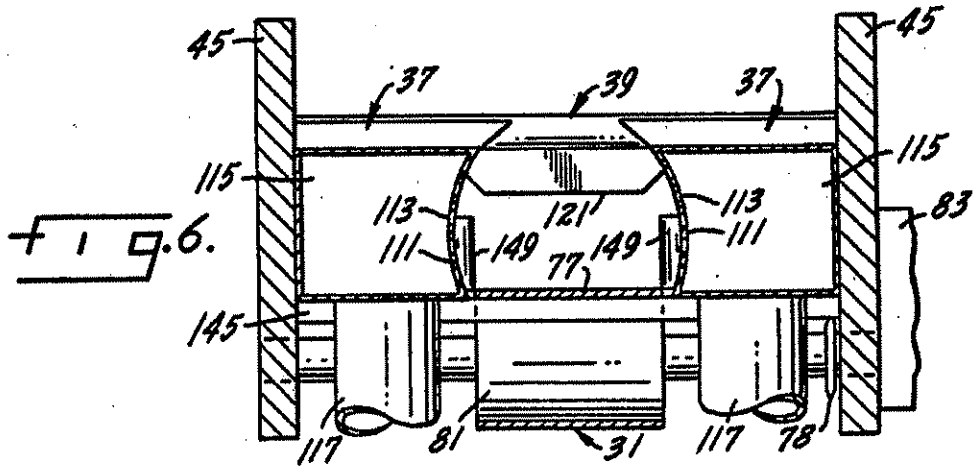


Fig. 6.

APPARATUS FOR FORMING FILLED DOUGH PRODUCTS

BACKGROUND AND SUMMARY OF THE INVENTION

I have described a method and disclosed apparatus for the continuous manufacture of traditionally shaped egg rolls in my U.S. Pat. No. 4,913,043, which patent is incorporated into this specification by reference. Further, I have disclosed an apparatus for molding egg roll fillings in my copending U.S. patent application Ser. No. 07/588,541, filed Sep. 25, 1990, which application is also incorporated by reference into this specification.

An object of my present invention is an apparatus which efficiently combines the egg roll filling molding function of my aforementioned patent application with the egg roll manufacturing function of my aforementioned issued patent to maximize the output of traditionally shaped egg rolls.

Another object of my invention is an apparatus for the continuous manufacture of traditionally shaped egg rolls which is economical to manufacture and easy to clean and maintain.

Yet another object of my invention is a simplified apparatus for rolling a sheet of dough around a cylindrical egg roll filling.

Still another object of my invention is a simplified apparatus for folding the corners of a sheet of dough inwardly over a cylindrical egg roll filling.

Other objects will become apparent from the following specification, claims and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is illustrated more or less diagrammatically in the following drawings wherein:

FIG. 1 is a top plan view of an apparatus of my invention, with some parts broken away and others shown in hidden lines;

FIG. 2 is a side elevational view of the apparatus of FIG. 1, with some parts broken away and others shown in hidden lines;

FIG. 3 is a partial, side elevational view of the apparatus of FIG. 2 showing a further step in the rolling of a sheet of dough around a cylindrical egg roll;

FIG. 4 is an enlarged, cross-sectional view taken along line 4—4 of FIG. 2;

FIG. 5 is an enlarged, cross-sectional view taken along line 5—5 of FIG. 2; and

FIG. 6 is an enlarged, cross-sectional view taken along line 6—6 of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

An apparatus 21 for forming the egg rolls in accordance with the teachings of this invention is shown in FIGS. 1–6 of the drawings. The apparatus includes a molding apparatus 23 for forming cylindrical egg roll fillings 25. The molding apparatus 23 is a somewhat modified form of the molding apparatus shown in FIGS. 1–9 of my pending and allowed U.S. patent application Ser. No. 07/588,541, filed Sep. 25, 1990. The apparatus 21 includes a framework 27 which is designed to be supported on a table or other support, which may be conventional and, therefore, is not shown for simplicity of illustration and explanation. The material of the framework 27 is usually a suitable metal such as stainless steel of the type which is approved for use in the food processing industry.

Mounted on the framework 27 is a first belt conveyor means 29 which extends the width of the framework and which is positioned at the top thereof and a second conveyor belt means 31 having a width approximately one-third of the width of the framework and extending longitudinally along the center line of the framework at a level below the level of the first conveyor belt means 29. A dough sheet folding means 33 is positioned between said first and second conveyor belt means. A mechanism 35 for providing creases on opposite sides of the sheet of dough in the direction of the length of travel of the sheet of dough along the conveyor belts is positioned near the beginning of the second conveyor belt means. A dough sheet corner folding means 37 is positioned on opposite sides of the second conveyor belt means 31 generally downstream of the first conveyor belt means 29. A transverse creasing means 39 for the sheet of dough is located downstream of the dough corner folding means 37 and a finished egg roll rolling and tightening means 41 is located at the downstream end of the second conveyor belt means 31.

The functions formed by the apparatus 21 of this invention are essentially the same as the functions performed by the apparatus 41 shown in my U.S. Pat. No. 4,913,043 but the apparatus 21 of this invention is constructed in a simpler and more efficient manner than the apparatus of my '043 patent.

The framework 27 includes side beams 45 and an end beam 47. The side beams and the end beam are bolted together. Of course, it should be understood and appreciated that other means of attachment, such as welding or the like, may be used instead of or in addition to the bolting. An upstanding plate 49 attached to one of the side beams 45 supports the filler molding mechanism 23 so that its mold housing 51 is centered above the first conveyor belt means 29, as shown most clearly in FIG. 1 of the drawings. The mold housing 51 is properly positioned by spacers 53 which are attached to the plate 49.

The filler molding mechanism 23 shown herein is similar to the device shown in FIGS. 1–9 of my previously mentioned patent application, but with some modifications which make it better suited to function as an integral part of the apparatus 21 of this invention. The modifications include the pistons 55 which are provided with convex ends. A scraper 57 is attached to an end wall of the molding housing 51 so that it engages the rotor 59 downstream of its discharge so that an egg roll filling 25 will be positively removed from the cavity 61 of the rotor and deposited on a square sheet 63 of dough which has been placed on the first conveyor belt means 29 at the upstream end thereof. The rotor 59 is driven by a shaft 65 connected to a suitable drive motor, which is not shown. An electric eye sensing device 67 is mounted on a wall of the mold housing to detect the placing of a sheet 63 of dough on the first conveyor belt means. The electric eye controls the timing of the discharge of egg roll filling 25 from the molding mechanism 23.

As is conventional, and as is shown in the drawings, the square sheet 63 of dough is positioned with a corner pointed in the direction of movement or, in other words, downstream of the first conveyor belt means 29. As is also conventional, the trailing edge of the sheet 63 of dough may be sprayed or brushed with a whole egg and water mixture for increase adhesion. Such a sheet of

dough is approximately six inches in length on each side. The cylindrical egg roll filler **25** is dropped on the sheet **63** of dough at approximately the center thereof, as shown in FIGS. **1** and **2** of the drawings.

The first conveyor belt means **29** includes a conveyor belt **71** which is driven by a roller **73** at its upstream end and has a smaller idler roller **75** at its downstream end. The second conveyor belt means **31** includes a conveyor belt **77** which is approximately one-third the width of the belt **71**, with the upstream end of the belt **77** located beneath the idler roller **75** at the downstream end of belt **71**. The roller **79** at the upstream end of conveyor belt **77** is driven by a chain **78** and in turn drives the roller **73** at the upstream end of the first conveyor belt means by means of a chain **80** so that both conveyor belts **71** and **77** move at the same linear speed. The conveyor belt **77** is driven by a roller **81** at its downstream end which in turn is driven by an electric motor **83** through a suitable gear arrangement, which is not shown in the drawings for clarity of illustration. The conveyor belts **71** and **77** may be constructed of a synthetic canvas-like material of the type suitable for use in the food processing industry.

The dough sheet folding means **33** functions to reversely fold the leading corner of the sheet of dough **63** around the cylindrical egg roll filler **25**. This mechanism includes a deflector in the form of a plate **91** which is located downstream of the downstream end of the conveyor belt **71**. The deflector plate **91** is supported on the side beams **45** of the framework **27** and inclined in an upwardly direction so as to bend the leading corner of the sheet of dough **63** in an upward direction, as shown in FIG. **2** of the drawings. To prevent the leading corner of the sheet **63** of dough from falling downwardly as it passes over the idler roller **75** at the downstream end of the conveyor belt **71**, a first air jet means **93** discharges air under pressure through a thin rectangular nozzle orifice against the underside of the sheet of dough, in an upward direction shown in FIG. **2** of the drawings, to support the corner until it engages the deflector plate **91**. The first air jet means **93** has a thin elongated, rectangular orifice which extends the width of the conveyor belt **71** and directs a stream of air rearwardly and upwardly from beneath the idler roller **75**, as shown in the drawings. The air for the first air jet means **93** may be supplied from a blower **95** or any other conventional source of air under pressure. While the first air jet means **93** provides an air stream of sufficient force to prevent the leading corner of the sheet **63** of dough from falling onto the belt **77** of the second conveyor means **31**, the force is not sufficient to also support the cylindrical egg roll filling **25**. When the cylindrical egg roll filling **25** reaches the downstream end of the conveyor belt **71**, it will drop onto the second conveyor belt means **31** bringing the sheet of dough **63** down with it.

A second air jet means **99** is located beneath the deflector **91** and discharges a stream of air in an upstream direction through a thin rectangular orifice towards the first conveyor belt means **29**. The stream of air will engage the leading edge of the sheet **63** of dough and force it to reversely fold around the cylindrical filling **25** in the manner shown in FIG. **3** of the drawings. The stream of air will also bend the trailing edge of the sheet **63** of dough downwardly into contact with the second conveyor belt **77**. The dough sheet folding means **33** described herein functions to achieve the same results as the dough deflector **101** which is shown and described in my aforementioned '043 patent. The sheet **63** of dough and the filling **25** are now in approximately the same condition as the sheet and filling shown in FIG. **1C** of my '043 patent. The stream of air under pressure from the second air jet means is directed through a thin rectangular orifice (not shown) which extends across the width of the conveyor belt **77**. This air may be supplied under pressure from a blower or any other conventional source of air under pressure.

The longitudinal creasing means **35** provides creases in the sheet **63** of dough on opposite sides of the cylindrical egg roll filling **25**. The creases are created by a pair of rollers **105** engaging the sheet of dough. Each roller **105** is mounted on a fixed stub shaft **107** extending inwardly from a side beam **45** of the framework **27**. These rollers are not powered but are rotated by engagement with the sheet **63** of dough as it moves along on the conveyor belt **77** of the second conveyor belt means **31**. The purpose for a longitudinally-extending crease in the sheet **63** of dough on each side of the filler **25** is to facilitate the folding of the corners of the sheet of dough over the filler.

The folding of the corners of the sheet **63** of dough is accomplished by means **37** which consists of an upwardly and outwardly inclined and inwardly flaring wall **111** located on each side of the conveyor belt **77**. In addition to being inclined upwardly and outwardly, the walls **111** converge in the downstream direction of movement of the conveyor belt **77** and provide a concave face to the conveyor belt **77** near the discharge end thereof, as shown in FIG. **6** of the drawings. Air discharge openings **113** in the form of small perforations are provided in the inclined and concave wall **111** for the exit of air under pressure. The pressurized air is supplied to chambers **115** located under the inclined and concave walls **111** and which in turn are supplied through ducts **117** by a source of air under pressure, preferably the same source which supplies the first air jet means **93** and second air jet means **99**. The jets of air exhausting from the openings **113** slightly lift the corners of the sheet **63** of dough and cooperate with the concave curvature of the walls **111** to fold these corners over the egg roll filling **25** and reduce friction between the sheet of dough and the walls **111**.

The transverse creasing mechanism **39** forms a transverse crease in the sheet **63** of dough immediately rearwardly of the filling **25**. This crease line is formed by one of the blades **121** formed as part of a free-wheeling paddle **123** which is mounted on a shaft **125** extending across the framework **27** of the apparatus **21**. The contact of one of the blades **121** with the sheet **63** of dough completes the folding of the corners and tightens the engagement of the folded leading corner of the sheet of dough with the filling **25**.

In order to complete the folding and rolling of the sheet of dough to obtain the final egg roll shape product **37** of my '043 patent, a rolling and tightening means **41** is provided. This means **41** includes an overhead conveyor belt **131** located immediately downstream of the paddle **123**. The overhead conveyor belt **131** is made of a rubberized material with a roughened gripping surface to engage the covering **63** of the egg roll filling **25**. The direction of movement of the lower run of this conveyor is opposite to the direction of movement of the upper run of conveyor belt **77**. The linear speed of the belt **131** may be approximately one-half the speed of the belt **77**, but this is adjustable. The belt **131** is supported on a forward roller **133** and a rearward roller

135. The rearward roller 135 has a gear 137 driven by a chain 139 which meshes with a gear 141 on the shaft of roller 81 of the second conveyor belt means 31. The gear 137 has a larger diameter than the gear 141 so that the conveyor belt 131 runs at a slower speed than the conveyor belt 77. The conveyor belt 131 is declined from its upstream end to its downstream end and is positioned above the belt 77 a sufficient distance so that it engages a completely folded and partially rolled dough and filling to complete the rolling to the traditional egg roll shape 37 of my '043 patent.

The belt 77 is supported by a plate 145 form the paddle 123 downstream for a substantial distance under the reverse rolling conveyor 131. On opposite sides of the belt 77, extending downstream from the paddle 123, are retainer conveyor belts 149. The function of these retainer conveyor belts is to prevent the partially rolled dough and filling from falling off the belt 77.

While one particular embodiment of the apparatus for practicing my invention has been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from the invention and, therefore, the purpose of the appended claims is to cover all such changes and modifications which fall within the scope of my invention.

Also, while the invention has been described for use in forming egg rolls, it should be appreciated that other items can be formed using the apparatus of my invention. Therefore, it should be appreciated that the present apparatus of my invention can be used to form other egg rolls into their desired shape and is not limited to egg rolls.

I claim:

1. An apparatus for forming a food item such as a traditionally shaped egg roll, including:

a first conveyor belt means for receiving and supporting a square sheet of dough and a cylindrical egg roll filling positioned on said dough and moving them on the first conveyor means with one corner of the sheet of dough pointed in the direction of movement of said first conveyor belt means,

a second conveyor belt means located at a lower level than first conveyor belt means and moving in the same direction of travel as said first belt means,

said first conveyor belt means terminating downstream at a location beyond the upstream end of said second conveyor means so that the sheet of dough and the cylindrical egg roll filling will discharge from said first conveyor belt means and be received by said second conveyor belt means,

first air jet means discharging in the direction of movement of said first conveyor belt means and against the underside of the sheet of dough as it leaves said first conveyor belt means to thereby support the leading corner of the sheet of dough as it moves off said first conveyor belt means,

a deflector located downstream of said first conveyor belt means and positioned to engage the leading corner of said square sheet of dough as said square sheet of dough leaves said first conveyor belt means and to bend said corner upwardly,

second air jet means discharging in a direction opposite to the direction of movement of said square sheet of dough to engage and thereby reversely fold the bent leading corner of said square sheet of dough against said cylindrical egg roll filling and bend down the trailing edge of the sheet of dough after the sheet of dough and the egg roll filling have dropped from the downstream end of said first conveyor belt means onto said second conveyor belt means,

means to crease the square sheet of dough along its length of movement immediately outwardly of the ends of the cylindrical egg roll filling,

third air jet means positioned on opposite longitudinal sides of said second conveyor belt means to lift the opposite corners of the square sheet of dough which are located outwardly of the creases and to fold them inwardly over the cylindrical egg roll filling,

paddle means to transversely crease the folded dough rearwardly of the cylindrical egg roll filling, and

means to roll the cylindrical egg roll filling in the direction opposite the direction of movement of the second conveyor belt means to fold the side and trailing corners of the sheet of dough into the traditional cylindrical egg roll shape.

2. An apparatus for folding an edge of a sheet of dough over a cylindrical filling to substantially encircle the cylindrical filling with dough, including:

a first conveyor for moving a sheet of dough carrying a cylindrical filling over a defined path with said first conveyor having a downstream end,

a second conveyor having an upstream end positioned below said downstream end of said first conveyor,

an upwardly inclined deflector positioned downstream of said downstream end of said first conveyor to receive the leading edge of the sheet of dough and bend it upwardly,

a first air jet means to discharge air against the underside of said sheet of dough as it leaves said downstream end of said first conveyor to support the leading edge of said sheet until said cylindrical filling leaves the downstream end of said first conveyor, and

a second air jet means to discharge air against the underside of said leading edge of said sheet of dough to reversely fold said leading edge against said cylindrical filling to encircle said cylindrical filling with said sheet of dough and to bend down the trailing edge of the sheet of dough as said sheet of dough and said cylindrical filling falls onto said second conveyor.

3. An apparatus for folding the corners of a square sheet of dough over a cylindrical filling positioned on the sheet of dough, including:

a narrow conveyor belt supporting the square sheet of dough and cylindrical filling with opposite corners of the sheet of dough extending laterally beyond the conveyor belt,

a supporting and bending means for the laterally extending corners of said sheet of dough positioned on each side of said narrow conveyor belt, said supporting and bending means including:

an upwardly and outwardly inclined wall positioned on each side of said conveyor belt,

said walls converging and curving inwardly in the downstream direction of movement of said conveyor belt,

a plurality of openings in said walls for the passage of air under pressure to direct said pressurized air to lift said laterally-extending corners of said sheet of dough and fold them over said cylindrical filling, and

means to supply air under pressure.

* * * * *

Exhibit H

US005672231A

United States Patent [19]

Willkens et al.

[11] Patent Number: 5,672,231

[45] Date of Patent: Sep. 30, 1997

[54] **METHOD AND APPARATUS FOR REMOVING LABEL FROM A CONTAINER**

[75] Inventors: **Daniel N. Willkens**, Freeville, N.Y.; **Neal D. Turner**, Brackney, Pa.

[73] Assignee: **Brandt Technologies, Inc.**, Windsor, N.Y.

[21] Appl. No.: **408,576**

[22] Filed: **Mar. 22, 1995**

[51] Int. Cl.[6] **B32B 35/00**

[52] U.S. Cl. **156/344**; 156/584; 15/65; 15/70; 15/316.1; 15/318.1; 15/405; 134/33; 134/37; 134/151

[58] Field of Search 156/234, 240, 156/344, 584; 15/59, 60, 65, 70, 316.1, 318.1, 405; 134/33, 37, 151, 172

[56] **References Cited**

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4,661,195	4/1987	Hopson	156/344
4,717,442	1/1988	Hopson	156/584
4,834,826	5/1989	Abe et al.	156/344
5,152,865	10/1992	Hurst	156/344
5,217,538	6/1993	Buchholz et al.	134/25.4
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Pp. 35 from EXAIR Corporation Catalogue (Received 12–1994).

Primary Examiner—Mark A. Osele
Attorney, Agent, or Firm—Sughrue, Mion, Zinn, Macpeak, and Seas.

[57] **ABSTRACT**

Method and apparatus for removing a label from a container which includes a cylindrical surface, by blowing air so as to be incident tangentially with respect to the cylindrical surface of the container and flow along the container surface toward a leading edge of the label as the container is rotated. An air knife having an air exit slit and a substantially planar surface disposed adjacent to and substantially perpendicular to the air exit slit utilizes the Coanda effect, such that air exiting from the air exit slit bends around and follows the substantially planar surface so as to flow tangentially to the cylindrical surface of the container and thereby remove the label as the container is rotated.

2 Claims, 5 Drawing Sheets

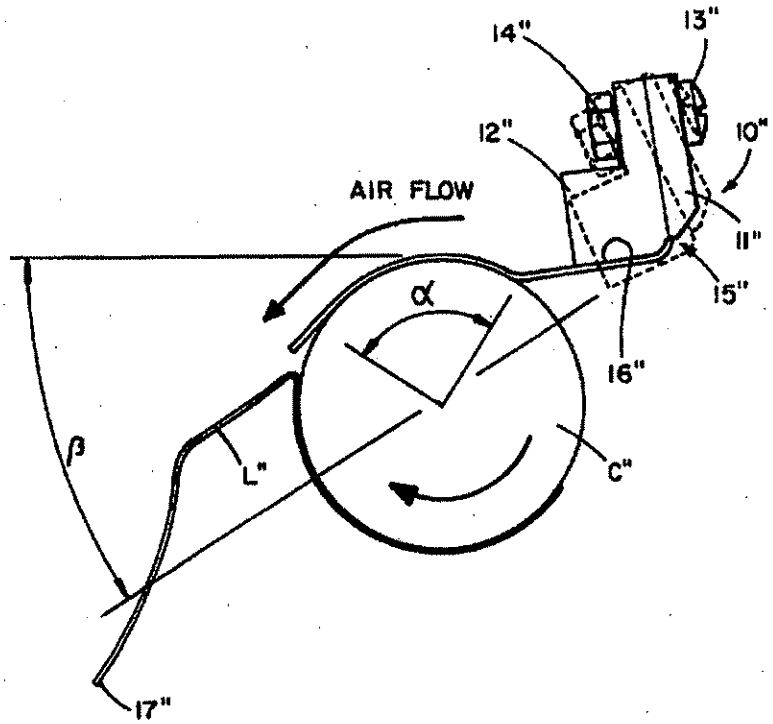


FIG. 1A

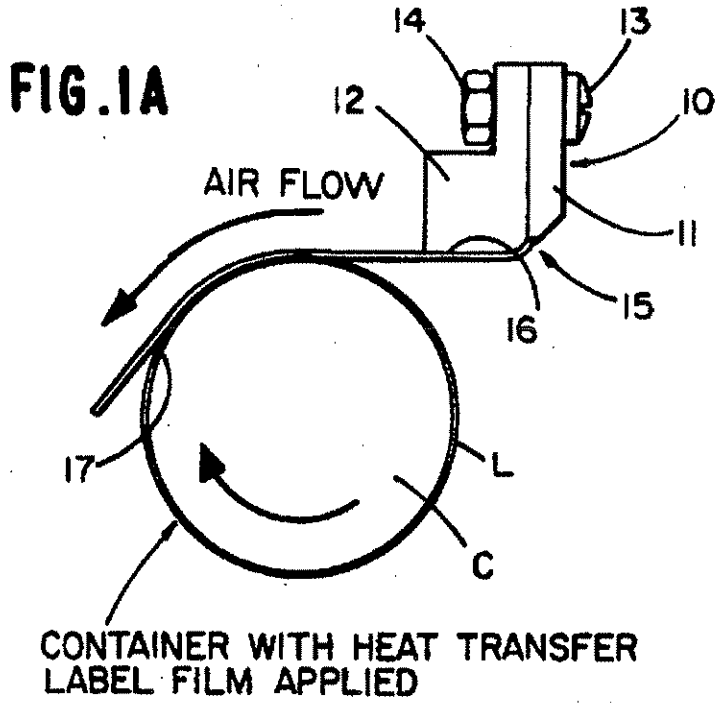

14
13
12
10
AIR FLOW
11
15
16
17
L
C
CONTAINER WITH HEAT TRANSFER LABEL FILM APPLIED

FIG. 1B

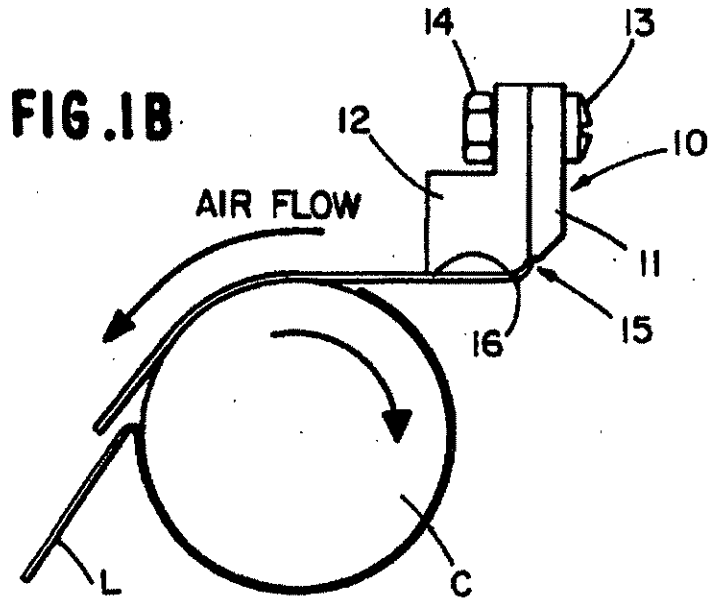

14
13
12
10
AIR FLOW
11
15
16
L
C

FIG. 1C

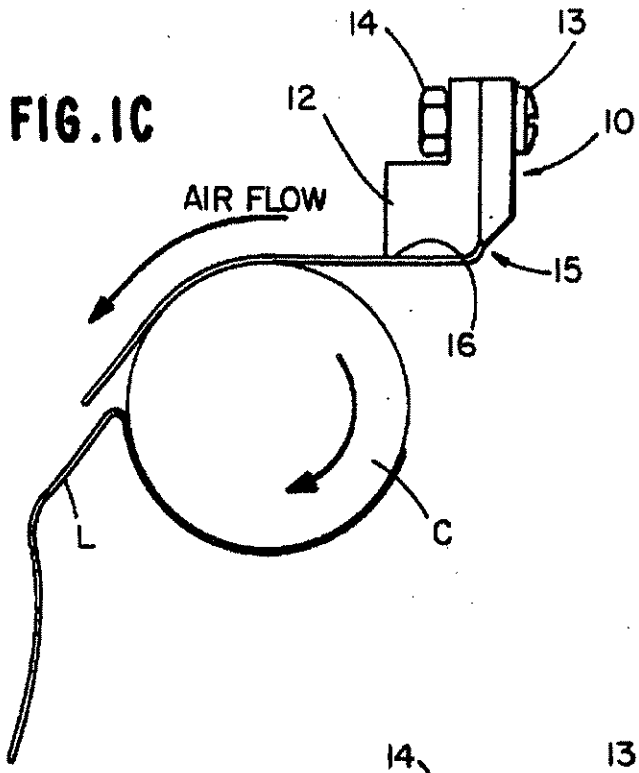

14
13
12
10
AIR FLOW
15
16
L
C

FIG. 1D

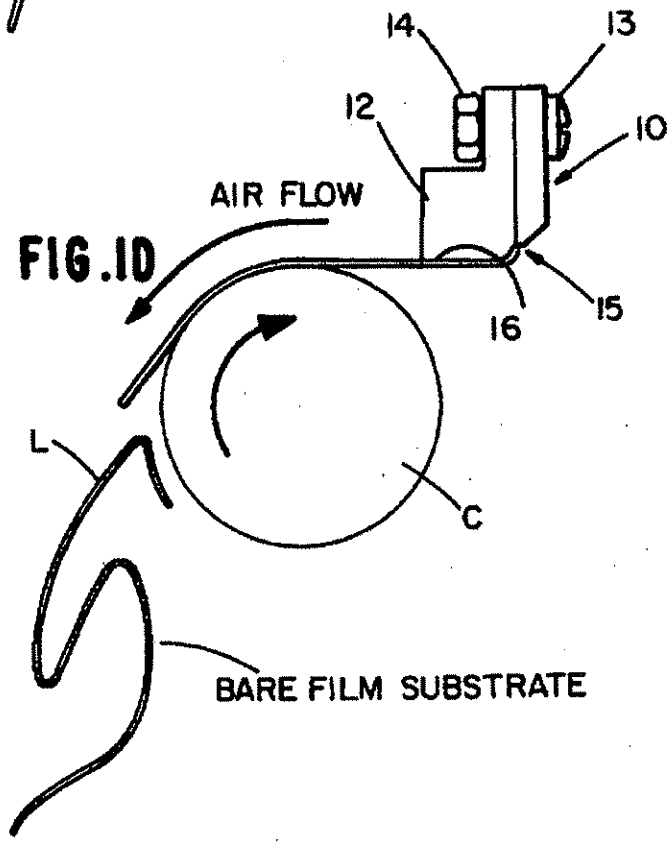

14
13
12
10
AIR FLOW
15
16
L
C
BARE FILM SUBSTRATE

FIG. 2

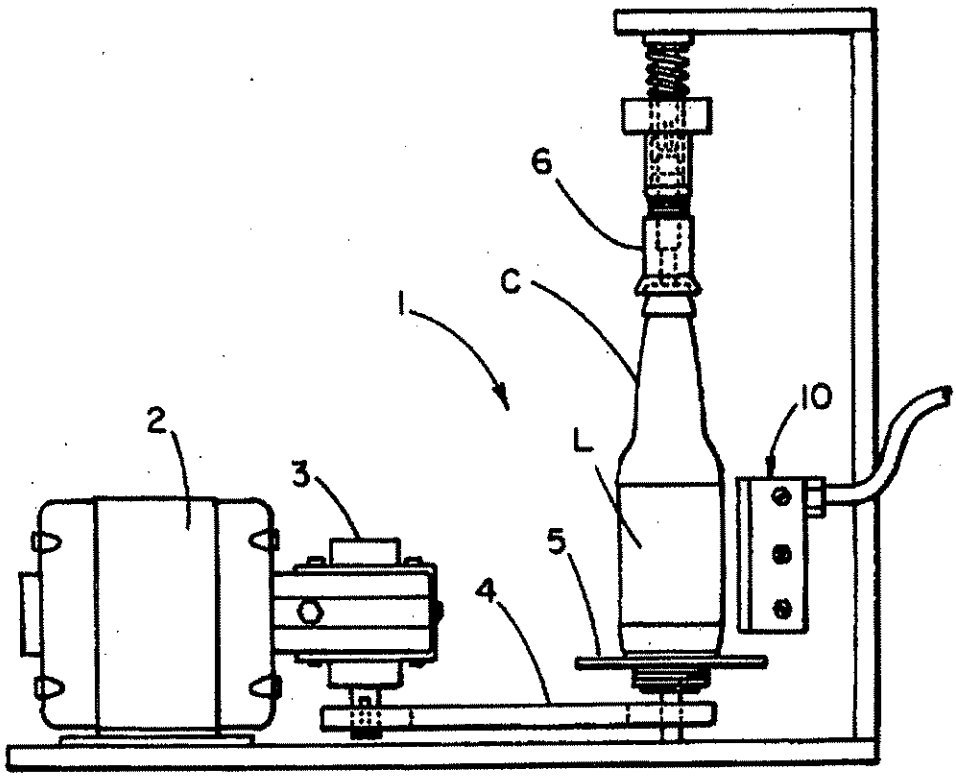


FIG.3

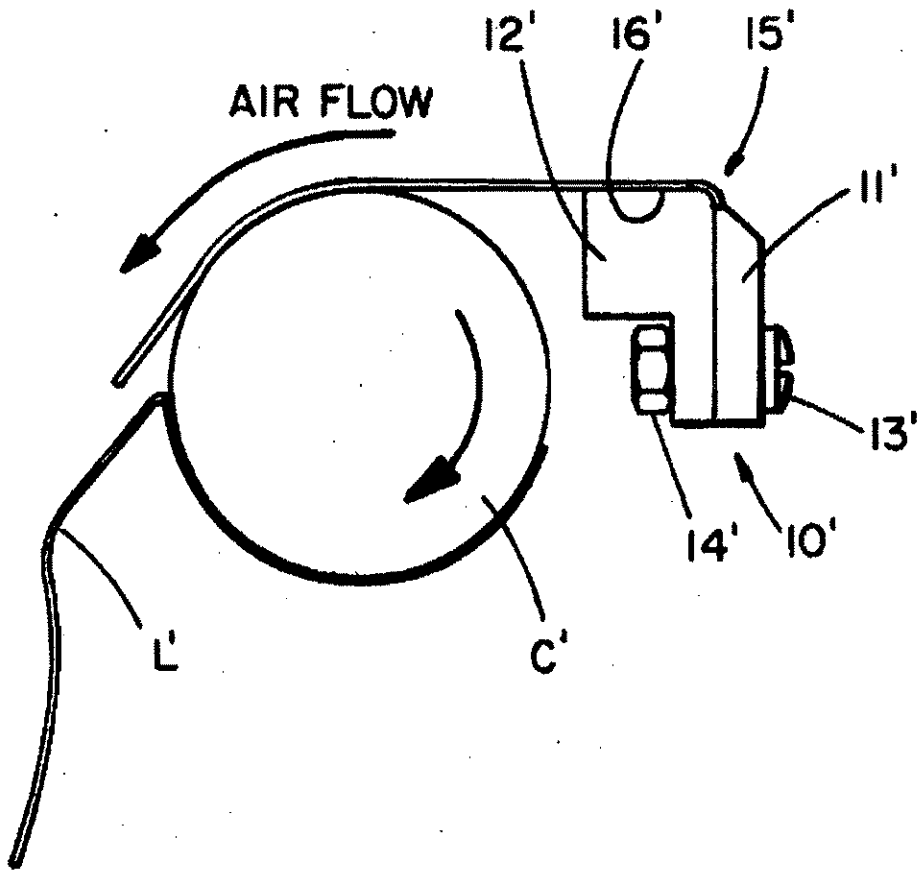
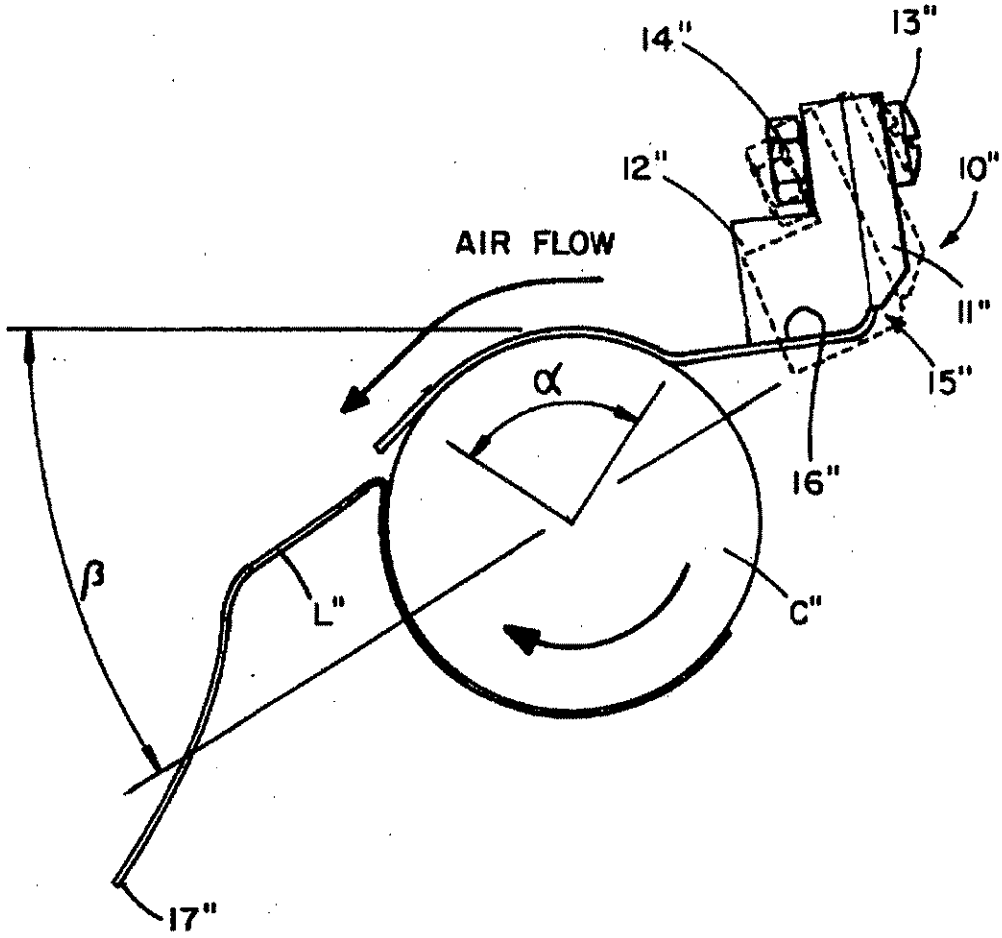


FIG.4



METHOD AND APPARATUS FOR REMOVING LABEL FROM A CONTAINER

BACKGROUND OF THE INVENTION

The present invention provides a method and apparatus for removing a label from a container and, in particular, a method and apparatus for removing a label from a container by blowing air so as to be incident tangentially with respect to a cylindrical surface of the container and flow along the container surface toward a leading edge of the label as the container is rotated.

In general, during the application of an ink only heat transfer label film to glass, metal or plastic containers, the label film is cut and applied around the container, thereby leaving a small gap between the leading and trailing edges of the applied label film. Once the transfer of the ink from the heat transfer label film has been effected, the label film is removed. Various methods and apparatuses have been disclosed for removing the label including mechanical devices such as a frictional force applying a member, and chemical means such as soaking in a solution to dissolve the adhesive.

It is also known from U.S. Pat. No. 4,661,195 (Hopson) to use a pair of air nozzles which provide air jets that force air between a label sleeve and an outer surface of a can to dislodge a label from the can. The cans are conveyed in a line along a conveyor. The air nozzles of Hopson '195 are arranged above the can and the can remains stationary during the ejection of air.

U.S. Pat. No. 4,834,826 (Abe et al.) discloses an apparatus and method for removing a label from a bottle by melting the label with hot air supplied by a hot air jet nozzle **10** having a vertically elongated slit. Accordingly, the label is cut by melting when exposed to the hot blast of air from the jet nozzle **10** which faces directly along the axis of the bottle as shown in FIG. **5** of Abe et al. The cut label is then blown off by pressurized air from four secondary nozzles **40**.

U.S. Pat. No. 4,013,497 (Wolf), U.S. Pat. No. 4,325,775 (Moeller), U.S. Pat. No. 4,717,442 (Hopson) and U.S. Pat. No. 5,317,794 (Lerner et al.) all relate to various methods and apparatuses for delabeling.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a simple and reliable method and apparatus for removing a label from a container which includes a cylindrical surface.

It is a further object of the present invention to provide a method and apparatus for removing a label from a container which utilizes high velocity air as opposed to mechanical or other methods and apparatuses of removal, so as to remove a label or film substrate more reliably and completely.

It is a still further object of the present invention to provide a method and apparatus for removing an ink only heat transfer film from glass, metal, or plastic containers once the transfer of ink has been effected onto the container.

In particular, the present invention provides a method of removing a label from a container which includes a cylindrical surface, comprising the steps of rotating the container; and blowing air so as to be incident tangentially with respect to the cylindrical surface of the container and flow toward a leading edge of the label as the container rotates, such that the label is removed.

The air blowing step includes blowing air from an air knife slit such that the air exits in an initial direction and then bends around a surface of the air knife so as to flow tangentially to the cylindrical surface of the container.

The present invention also provides an apparatus for removing a label from a container including a cylindrical surface, comprising means for rotating the container; and means for blowing air so as to be incident tangentially with respect to the cylindrical surface of the container and flow toward a leading edge of the label as the container is rotated by the means for rotating, such that the label is removed.

The means for blowing air comprises an air knife having an air exit slit directed in an initial direction and a substantially planar surface disposed adjacent to and substantially perpendicular to the air exit slit, such that air exiting from the air exit slit bends around and follows the substantially planar surface so as to flow tangentially to the cylindrical surface of the container.

Also provided is a method of removing a label from a container which includes a cylindrical surface, the label having a leading edge and a trailing edge, the method comprising the steps of rotating the container; and blowing air such that the air impacts the container at a location upstream of the leading edge of the label and follows the cylindrical surface toward the leading edge of the label so as to meet the leading edge of the label as the container rotates, thereby to remove the label from the container.

The air blowing step may include blowing air so as to be incident tangentially with respect to the cylindrical surface of the container and then follow around the cylindrical surface of the rotating container to meet the leading edge of the label.

Alternatively, the air blowing step includes blowing air so as to be incident non-tangentially with respect to the cylindrical surface of the container and then follow around the cylindrical surface of the rotating container to meet the leading edge of the label.

BRIEF DESCRIPTION OF THE DRAWINGS

Other features and advantages of the present invention will be apparent from the following description taken in connection with the accompanying drawings, wherein:

FIGS. **1A**, **1B**, **1C** and **1D** are schematic explanatory illustrations of the present invention as viewed from the top and show removal of a label film throughout the removal process according to one embodiment of the present invention;

FIG. **2** illustrates the means for rotating the container and also an elevational view of the air knife;

FIG. **3** is a schematic illustration as viewed from the top of a further embodiment according to the present invention; and

FIG. **4** is a schematic illustration as viewed from the top of a still further embodiment according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The invention will now be described with reference to the drawings. More specifically, a container C made, for example, from glass, metal or plastic, is mounted for rotation on a means for rotating **1** which may comprise a drive motor **2**, a gear reduction device **3**, a drive belt **4**, a rotatable container support **5**, and a hold-down device **6** for holding the container C on the container support **5** (see FIG. **2**). Accordingly, the drive motor **2** drives the drive belt **4** through the gear reduction means **3** so as to rotate the

container support 5. The hold-down device 6 holds the container C on the container support 5, while permitting the container to rotate together with the container support 5 during removal of the label, as will be discussed in more detail below.

As shown in FIG. 1A, the label film L has been cut and applied around a container. Once the transfer of the ink from the heat transfer label film or film substrate has been effected, the label film must then be removed. The present invention is directed to a method and apparatus for removing such a heat transfer label film or a label in general (hereinafter referred to simply as the "label"). A means for blowing air is mounted such that the air flow is directed so as to be incident along a tangent to the diameter of a cylindrical surface of the container C. The means for blowing air may take the form of an air knife, air curtain, or the like. The drawing figures of the present invention show an air knife 10. The air knife 10 comprises a pair of plates 11 and 12 which are fastened together by suitable fastening means such as a threaded member 13 and bolt 14 (only one of which fastening means is shown in FIGS. 1A–1D), so as to form an adjustable air knife exit slit 15 from which high velocity air exits. The plate 12 extends slightly beyond the edge of plate 11. As shown in the first embodiment of FIGS. 1A through 1D, the air knife 10 is oriented such that the air exit slit 15 of the air knife is directed so as to be perpendicular to a line which is tangent to the container C.

Plate 12 of the air knife 10 includes a substantially planar surface 16 disposed adjacent to and substantially perpendicular to the air exit slit 15. Accordingly, when air exits from the air exit slit 15, it bends around and follows the substantially planar surface 16 of the air knife 10 so as to flow tangentially to the cylindrical surface of the container C. Note that the distance between the plate 12 and the container C is exaggerated in FIG. 2 to avoid confusion. The reason the air bends around the substantially planar surface 16 is due to the fluid flow phenomenon known as the Coanda effect, also referred to as the wall attachment effect. The Coanda effect is the tendency of a flowing fluid to follow a surface against which the fluid is flowing even as the surface changes direction. The primary stream of air which follows the surface 16 also entrains surrounding air.

The present inventors have also observed that the Coanda effect transfers to the cylindrical surface of the container C such that the air flow attaches to the cylindrical container surface and bends around the diameter for a given distance as is apparent from FIGS. 1A through 1D. This results in a more efficient use of the air supply for a given air velocity.

Thus, by taking advantage of the Coanda effect, rather than point the air knife slit 15 directly at the leading edge 17 of the label L, the air knife 10 is arranged as shown in FIGS. 1A through 1D such that the air slit 15 is directed at a position off-set from the rotational axis of the container C.

The operation of the present invention will now be described with reference to FIGS. 1A through 1D.

Again, once the transfer of the ink from the heat transfer label film has been effected, the label or film substrate L is then removed from the container C. In order to effect removal of the label L, the air knife 10 is mounted as described in detail above such that the air flow will be directed so as to be incident tangentially with respect to the cylindrical surface of the container C. The container C is rotated by the rotating means 1 shown in FIG. 2 and air is then blown from the air knife 10 and the air bends around the one plate member 12 of the air knife 10 due to the Coanda effect as explained above so as to be incident tangentially to the container C and then continues to flow around the container surface toward the leading edge 17 of the label L as the container is rotated.

As the container C continues to rotate, the label L begins to peel off as the air meets the leading edge 17 as shown in FIG. 1B. Continued rotation permits the air flow to blow off the remaining portion of the label as shown in FIGS. 1C and 1D. After the container C makes one full rotation with the air flow blowing tangentially with respect to the container, the label n is blown free from the container, thereby leaving the ink only on the container. The ink on the container corresponds, for example, to a beverage label or the like.

The timing of the on and off of the air flow from the air knife 10 with respect to the rotation of the container C may be controlled by any suitable control means, such as a microprocessor, computer, or the like.

EXAMPLE 1

A container, having the ink transferred from the heat transfer label film or carrier, was delivered to a position in front of an air knife. The previously applied label film was formed of polypropylene material and is 3.75" wide, 7.125" long, and 0.002" thick. The container was a standard 12 oz. long neck beer bottle having a label panel diameter of 2.38". The air knife was 4.00" high and had an air slit width of 0.005" and a length of 3.5". The air knife face or blowing surface was positioned 0.5" from the container surface such that the air velocity was directed at the container surface and slightly tangent to the container with the air velocity opposing the rotation of the container. The container with the label film applied was then rotated at 176 rpm in front of the air knife. The air was applied at 80 psi with a consummation rate of 200 SCFM. The air was turned on at a point in the container rotation so as to meet the leading edge of the label film on the bottle. The air was on for 1.5 rotations of the container. During the rotation, the label film was blown cleanly from the container leaving the transferred ink undamaged. The removed label film was transported by the air stream to collection devices and then separated from the air stream.

EXAMPLE 2

It was further discovered that for the best results, the air knife air slit should be at least equal to or slightly longer than the width of the label film being removed. The following exemplary test was conducted:

The label film length was 7.1"
The label film width was 3.75"
The container diameter was 2.45"
The container was rotated at 250 rpm
The air pressure at the air knife was 60 psi
The air knife air slit gap was 0.004"

TABLE

Label Film Width	Air-Knife Slot Length	Observed Film Removal
3.75"	4.25"	Excellent
3.75"	4.0"	Excellent
3.75"	3.5"	Marginal
3.75"	3.0"	Poor

With respect to the above, the film removed with the "Excellent" observation was done without wrinkles or distortion, and was fully removed before one full revolution.

On the other hand, the film removal indicated as "Marginal" was wrinkled and required a complete revolution. Finally, the film removal indicated as "Poor" was characterized by the label film not being fully removed.

FIG. 3 shows an alternative embodiment of the present invention which likewise utilizes the Coanda effect such that the air flow exiting from an air knife slit 15' bends around a substantially planar surface 16' of the air knife 10' so as to flow tangentially to the cylindrical surface of the container C'. However, in the embodiment of FIG. 3, the air knife 10' is arranged adjacent to the container C' (i.e., the mirror image of the first embodiment) so that the air exit slit 15' of the air knife 10' points away from the container C'. Note that like elements are denoted by the same reference numeral except that a prime is included.

FIG. 4 shows a still further embodiment where the air knife 10" is slightly canted such that the air flow strikes the container C" in a non-tangential fashion and then follows around the cylindrical surface of the container C" until it meets the leading edge 17" of the label L" and thereafter removes the label L" in a manner similar to that of the first embodiment. Like elements are denoted by the same reference numeral except that a double prime is included.

More specifically, in the FIG. 4 embodiment, the angle β of the air knife in relation to the container effects the air flow. As observed, the air flow will follow around the surface of the container anywhere from 90° to 120° (see angle α). This "following" effect takes place with the knife being in a range from tangent (0°) (see FIGS. 1A–1D) to about 40° rotated toward the container. From 40° to 50°, the air flow follows the container only slightly, but in both directions around the container thereby reducing the ability to remove the label film. From 50° to 90°, the effect of the air following is the same as from tangent (0°) to 40° except in the opposite direction around the container.

While a single air knife is shown in the embodiments, it should be understood that several of such air knives may be mounted in series and timed to the rotation of a plurality of containers for high speed continuous applications.

It is contemplated that numerous modifications may be made to the method and apparatus for removing a label from a container of the present invention without departing from the spirit and scope of the invention as defined in the following claims.

What is claimed is:

1. A method of removing a label from a container which includes a cylindrical surface, the label having a leading edge and a trailing edge, said method comprising the steps of:

a) rotating the container; and

b) blowing air such that the air impacts the container at a location upstream of the leading edge of the label and follows the cylindrical surface toward the leading edge of the label so as to meet the leading edge of the label as the container rotates, thereby to remove the label from the container, wherein said air blowing step includes blowing air so as to be incident non-tangentially with respect to the cylindrical surface of the container and then follow around the cylindrical surface of the rotating container to meet the leading edge of the label.

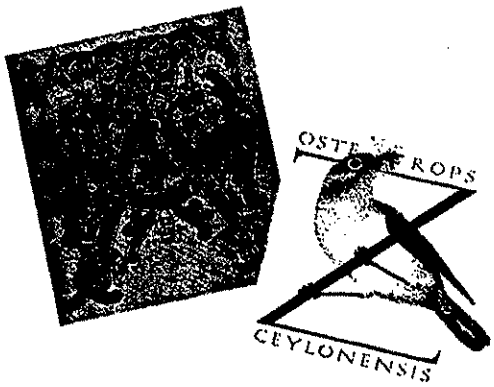
2. The method according to claim 1, wherein said air blown in said air blowing step follows around the cylindrical surface of the container in the range of 90° to 120° between the location where the air impacts the container to where the air meets the leading edge of the label.

* * * * *

Exhibit I

The American Heritage® Dictionary of the English Language

FOURTH EDITION



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of a private or intimate nature. ❖ *adv.* Privately with only two individuals involved: *dining à deux.* [French : *à,* by, at + *deux,* two.]

ad fem•i•nam (ăd fĕm′ĭ-năm′, -nəm) *adj.* Appealing to irrelevant personal considerations concerning women, especially prejudices against them. See Usage Note at **ad hominem.** [Latin *ad,* to + *fēminam,* accusative of *fēmina,* woman.] —**ad fem′i•nam′** *adv.*

ADH *abbr.* antidiuretic hormone

ADHD *abbr.* attention deficit hyperactivity disorder

ad•here (ăd-hîr′) *v.* **-hered, -her•ing, -heres** —*intr.* **1.** To stick fast by or as if by suction or glue. **2.** To remain devoted to or be in support of something: *adhered to her beliefs.* **3.** To carry out a plan, scheme, or operation without deviation: *We will adhere to our plan.* —*tr.* To cause to adhere; make stick. [French *adhérer,* from Latin *adhaerēre,* to stick to : *ad-,* ad- + *haerēre,* to stick.]

ad•her•ence (ăd-hîr′əns, -hĕr′-) *n.* **1.** The process or condition of adhering. **2.** Faithful attachment; devotion: *"Adherence to the rule of law . . . is a very important principle"* (William H. Webster).

ad•her•ent (ăd-hîr′ənt, -hĕr′-) *n.* A supporter, as of a cause or individual: *a vote that pleased adherents of education reform.* ❖ *adj.* **1.** Sticking or holding fast. **2.** *Botany* Joined but not united. Used of dissimilar parts or organs. —**ad•her′ent•ly** *adv.*

ad•he•sion (ăd-hē′zhən) *n.* **1.** The act or state of adhering. **2.** Attachment or devotion; loyalty. **3.** Assent or agreement to join. **4.** *Medicine* **a.** A condition in which bodily tissues that are normally separate grow together. **b.** A fibrous band of scar tissue that binds together normally separate anatomical structures. **5.** *Physics* The physical attraction or joining of two substances, especially the macroscopically observable attraction of dissimilar substances. [French *adhésion,* from Latin *adhaesiō, adhaesiōn-,* from *adhaesus,* past participle of *adhaerēre,* to adhere. See ADHERE.]

ad•he•si•ot•o•my (ăd-hē′zē-ŏt′ə-mē) *n., pl.* **-mies** Surgical division or separation of adhesions.

ad•he•sive (ăd-hē′sĭv, -zĭv) *adj.* **1.** Tending to adhere; sticky. **2.** Gummed so as to adhere. **3.** Tending to persist; difficult if not impossible to shake off: *"He feels an adhesive dread, a sudden acquaintance with the . . . darker side of mankind"* (George F. Will). ❖ *n.* A substance, such as paste or cement, that provides or promotes adhesion. —**ad•he′sive•ly** *adv.* —**ad•he′sive•ness** *n.*

adhesive tape *n.* A tape lined on one side with an adhesive.

ad hoc (ăd hŏk′, hōk′) *adv.* For the specific purpose, case, or situation at hand and for no other: *a committee formed ad hoc to address the issue of salaries.* ❖ *adj.* **1.** Formed for or concerned with one specific purpose: *an ad hoc compensation committee.* **2.** Improvised and often impromptu: *"On an ad hoc basis, Congress has . . . placed . . . ceilings on military aid to specific countries"* (New York Times). [Latin : *ad,* to + *hoc,* neuter accusative of *hic,* this.]

ad hoc•ism also **ad-hoc•ism** (ăd hŏk′ĭz-əm, hōk′kĭz-) *n.* The tendency to establish temporary, chiefly improvisational policies and procedures to deal with specific problems and tasks: *"In the absence of specific policies carefully tended by specialists, ad hocism took root"* (U.S. News & World Report).

ad hom•i•nem (hŏm′ə-nĕm′, -nəm) *adj.* Appealing to personal considerations rather than to logic or reason: *Debaters should avoid ad hominem arguments that question their opponents' motives.* [Latin : *ad,* to + *hominem,* accusative of *homō,* man.] —**ad hom′i•nem′** *adv.*

Usage Note As the principal meaning of the preposition *ad* suggests, the *homo* of *ad hominem* was originally the person to whom an argument was addressed, not its subject. The phrase denoted an argument designed to appeal to the listener's emotions rather than to reason, as in the sentence *The Republicans' evocation of pity for the small farmer struggling to maintain his property is a purely ad hominem argument for reducing inheritance taxes.* This usage appears to be waning; only 37 percent of the Usage Panel finds this sentence acceptable. The phrase now chiefly describes an argument based on the failings of an adversary rather than on the merits of the case: *Ad hominem attacks on one's opponent are a tried-and-true strategy for people who have a case that is weak.* Ninety percent of the Panel finds this sentence acceptable. The expression now also has a looser use in referring to any personal attack, whether or not it is part of an argument, as in *It isn't in the best interests of the nation for the press to attack him in this personal, ad hominem way.* This use is acceptable to 65 percent of the Panel. • *Ad hominem* has also recently acquired a use as a noun denoting personal attacks, as in *"Notwithstanding all the ad hominem, Gingrich insists that he and Panetta can work together"* (Washington Post). This usage may raise some eyebrows, though it appears to be gaining ground in journalistic style. • A modern coinage patterned on *ad hominem* is *ad feminam,* as in *"Its treatment of Nabokov and its ad feminam attack on his wife Vera often border on character assassination"* (Simon Karlinsky). Though some would argue that this neologism is unnecessary because the Latin word *homo* refers to humans generically, rather than to the male sex, in some contexts *ad feminam* has a more specific meaning than *ad hominem,* being used to describe attacks on women as women or because they are women, as in *"Their recourse . . . to ad feminam attacks evidences the chilly climate for women's leadership on campus"* (Donna M. Riley).

ad•i•a•bat•ic (ăd′ē-ə-băt′ĭk, ā′dī-ə-) *adj.* Of, relating to, or being a reversible thermodynamic process that occurs without gain or loss of heat and without a change in entropy. [From Greek *adiabatos,* impassable : *a-,* not; see A-[1] + *diabatos,* passable (*dia-,* dia- + *batos,* passable, from *bainein,* to go; see **gʷā-** in Appendix I).] —**ad′i•a•bat′i•cal•ly** *adv.*

a•dieu (ə-dyōō′, ə-dōō′) *interj.* Used to express farewell. ❖ *n., pl.* **a•dieus** or **a•dieux** (ə-dyōōz′, ə-dōōz′) A farewell. [Middle English, from Old French *a dieu,* (I commend you) to God : *a,* to (from Latin *ad;* see AD-) + *Dieu,* God (from Latin *deus;* see **dyeu-** in Appendix I).]

A•di•ge (ä′dē-jā′, ä′dē-jē′) A river of northeast Italy rising in the Alps and flowing about 410 km (255 mi) generally south then east to the Adriatic Sea at the Gulf of Venice.

ad in•fi•ni•tum (ăd ĭn′fə-nī′təm) *adv. & adj.* To infinity; having no end. [Latin *ad,* to + *īnfīnītum,* accusative of *infīnītus,* infinite.]

ad in•ter•im (ĭn′tər-əm) *adv.* In or for the meantime; temporarily. ❖ *adj.* Acting or done ad interim; temporary. See synonyms at **temporary.** [Latin *ad,* to, for + *interim,* the meantime.]

a•di•os (ä′dē-ōs′) *interj.* Used to express farewell. [Spanish *adiós,* probably translated from French *à dieu.* See ADIEU.]

a•dip•ic acid (ə-dĭp′ĭk) *n.* A white crystalline dicarboxylic acid, $C_6H_{10}O_4$, that is derived from oxidation of various fats, slightly soluble in water and soluble in alcohol and acetone, and used especially in the manufacture of nylon and polyurethane foams. [From Latin *adeps, adip-,* fat.]

ad•i•po•cere (ăd′ə-pō-sîr′) *n.* A brown, fatty, waxlike substance that forms on dead animal tissues in response to moisture. [ADIPO(SE) + Latin *cēra,* wax.]

ad•i•po•cyte (ăd′ə-pō-sīt′) *n.* See **fat cell.**

ad•i•pose (ăd′ə-pōs′) *adj.* Of, relating to, or composed of animal fat; fatty. ❖ *n.* The fat found in adipose tissue. [New Latin *adipōsus,* from Latin *adeps, adip-,* fat.] —**ad′i•pose′ness, ad′i•pos′i•ty** (-pŏs′ĭ-tē) *n.*

adipose tissue *n.* A type of connective tissue that contains stored cellular fat.

Ad•i•ron•dack chair (ăd′ə-rŏn′dăk′) *n.* An outdoor armchair having an angled back and seat made of wide, usually wooden slats.

Adirondack Mountains A group of mountains in northeast New York between the St. Lawrence River valley in the north and the Mohawk River valley in the south. The range is part of the Appalachian system and rises to 1,629.9 m (5,344 ft). Lakes, forests, and numerous winter sports resorts, including Lake Placid, site of the 1932 and 1984 Winter Olympics, attract many tourists.

ad•it (ăd′ĭt) *n.* An almost horizontal entrance to a mine. [Latin *aditus,* access, from past participle of *adīre,* to approach : *ad-,* ad- + *īre,* to go; see **ei-** in Appendix I.]

adj. *abbr.* **1.** adjective **2.** adjunct **3. Adj.** adjutant

ad•ja•cen•cy (ə-jā′sən-sē) *n., pl.* **-cies 1.** The state of being adjacent; contiguity. **2.** A thing that is adjacent.

ad•ja•cent (ə-jā′sənt) *adj.* **1.** Close to; lying near: *adjacent cities.* **2.** Next to; adjoining: *adjacent garden plots.* [Middle English, from Latin *adiacēns, adiacent-,* present participle of *adiacēre,* to lie near : *ad-,* ad- + *iacēre,* to lie; see **yē-** in Appendix I.] —**ad•ja′cent•ly** *adv.*

adjacent angle *n.* Either of two angles having a common side and a common vertex.

ad•jec•ti•val (ăj′ĭk-tī′vəl) *adj.* Of, relating to, or functioning as an adjective. —**ad′jec•ti′val•ly** *adv.*

ad•jec•tive (ăj′ĭk-tĭv) *n. Abbr.* **a.** or **adj. 1.** The part of speech that modifies a noun or other substantive by limiting, qualifying, or specifying and distinguished in English morphologically by one of several suffixes, such as *-able, -ous, -er,* and *-est,* or syntactically by position directly preceding a noun or nominal phrase. **2.** Any of the words belonging to this part of speech, such as *white* in the phrase *a white house.* ❖ *adj.* **1.** Adjectival: *an adjective clause.* **2.** *Law* Prescriptive; remedial: *adjective law.* **3.** Not standing alone; derivative or dependent. [Middle English, from Old French *adjectif,* from Late Latin *adiectīvus,* from *adiectus,* past participle of *adicere,* to add to : *ad-,* ad- + *iacere,* to throw; see **yē-** in Appendix I.] —**ad′jec•tive•ly** *adv.*

adjective pronoun *n.* A pronoun acting as an adjective, such as *which* in *which dictionaries?*

ad•join (ə-join′) *v.* **-joined, -join•ing, -joins** —*tr.* **1.** To be next to; be contiguous to: *property that adjoins ours.* **2.** To attach: *"I do adjoin a copy of the letter that I have received"* (John Fowles). —*intr.* To be contiguous. [Middle English *ajoinen,* from Old French *ajoindre, ajoin-,* from Latin *adiungere,* to join to : *ad-,* ad- + *iungere,* to join; see **yeug-** in Appendix I.]

ad•join•ing (ə-joi′nĭng) *adj.* Neighboring; contiguous.

ad•journ (ə-jûrn′) *v.* **-journed, -journ•ing, -journs** —*tr.* To suspend until a later stated time. —*intr.* **1.** To suspend proceedings to another time or place. **2.** To move from one place to another: *After the meal we adjourned to the living room.* [Middle English *ajournen,* from Old French *ajourner* : *a-,* to (from Latin *ad-;* see AD-) + *jour,* day (from Late Latin *diurnum,* from Latin *diurnus,* daily, from *diēs,* day; see **dyeu-** in Appendix I).] —**ad•journ′ment** *n.*

Adjt. *abbr.* adjutant

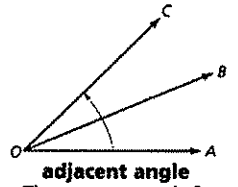
ad•judge (ə-jŭj′) *tr.v.* **-judged, -judg•ing, -judg•es 1a.** To determine or decide by judicial procedure; adjudicate. **b.** To order judicially; rule. **c.** To award (damages, for example) by law. **2.** To regard, consider, or deem: *was adjudged incompetent.* [Middle English *ajugen,* from Old French *ajuger,* from Latin *adiūdicāre.* See ADJUDICATE.]

ad•ju•di•cate (ə-jōō′dĭ-kāt′) *v.* **-cat•ed, -cat•ing, -cates** —*tr.* **1.** To hear and settle (a case) by judicial procedure. **2.** To study and settle (a dispute or conflict): *The principal adjudicated our quarrel.* —*intr.* To act as a judge. [Latin *adiūdicāre, adiūdicāt-,* to award to (judicially) : *ad-,* ad- + *iūdicāre,* to judge (from *iūdex,* judge; see JUDGE).] —**ad•ju′di•ca′tion** *n.* —**ad•ju′di•ca′tive** *adj.* —**ad•ju′di•ca′tor** *n.*

ad•junct (ăj′ŭngkt′) *n.* **1.** Something attached to another in a depen-

Adirondack chair

adit
Eureka Mine, Death Valley, California



adjacent angle
The common vertex is *O;* angle *AOB* is adjacent to angle *BOC.*

ă pat	oi boy
ā pay	ou out
âr care	o͝o took
ä father	o͞o boot
ĕ pet	ŭ cut
ē be	ûr urge
ĭ pit	th thin
ī pie	*th* this
îr pier	hw which
ŏ pot	zh vision
ō toe	ə about, item
ô paw	♦ regionalism

Stress marks: ′ (primary); ″ (secondary), as in **dictionary** (dĭk′shə-nĕr′ē)

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I, Richard H. Morse, hereby certify that on November 7, 2005, I caused to be electronically filed a true and correct copy of the foregoing document with the Clerk of Court using CM/ECF which will send notification of such filing to the following counsel of record:

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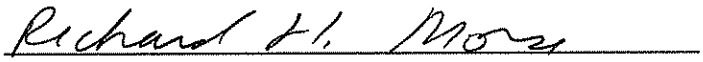

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